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July 17, 1997

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VIA MESSENGER

John Cimko, Jr.
Chief, Policy Division
Wireless Telecommunications Bureau
Federal Communications Commission
2025 M Street, N.W., Suite 5202
Washington, DC 20554

RECEIVED

JUL 17 1997

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Re: CC Docket No. 94-102

Dear Mr. Cimko:

During the June 26, 1997 meeting between SnapTrack, Inc. ("SnapTrack") and the Policy Division of the Wireless Telecommunications Bureau, we discussed the availability of public data on the rate of turnover of cellular, PCS and other wireless service handsets.

Attached to this letter is a spreadsheet analysis SnapTrack has prepared based on public record data compiled by Donaldson, Lufkin & Jenrette and Hambrecht & Quist, two well-known investment and market analyst firms concentrating on technology industries. The data indicate, as noted during our meeting, that given historical and projected handset turnover rates, nearly two-thirds of cellular handsets (66%) and almost all PCS handsets (94%) could be equipped with location-detection technologies by 2001, the deadline for implementation of the "Phase II" Automatic Location Information ("ALI") requirement under Section 20.18(e) of the Commission's Rules.

Along with the spreadsheet, we have also included relevant excerpts from the underlying source documents themselves:

Donaldson, Lufkin & Jenrette, *The Wireless Communications Industry*
(Spring 1997)

Rakesh Shood, *The Wireless Infrastructure Market: No Longer*
"Probably Coming Soon," Industry Report (Hambrecht & Quist,
LLC, Feb. 24, 1997)

The consequences of this rapid turnover in wireless handsets for the Commission's decisions on ALI accuracy standards are evident. First, to the extent policy concerns exist about the scope of the "embedded" base of wireless CPE, those concerns will diminish rapidly in the next several years, particularly given the projected market penetration of digital subscriber equipment. Second, where ALI is provisioned via a handset-based solution, i.e., "location-enabled handsets" (capable of far greater locational accuracy than the current rule requires), the accelerating turnover of handsets makes it possible for wireless carriers to meet and exceed their Phase II obligation—to enable PSAPs to locate the caller within 125 meter accuracy for at least 67% of all wireless E911 calls—with handset-based technologies.

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Please feel free to contact me if you have any questions regarding this data. Pursuant to the Commission's "permit-but-disclose" *ex parte* rules, two copies of this letter are contemporaneously being filed with the Secretary for inclusion in the record of this docket.

Sincerely,

A handwritten signature in black ink, appearing to read "G. B. Manishin", with a long horizontal flourish extending to the right.

Glenn B. Manishin

GBM:hs

Enclosures

cc: Daniel F. Grosh, Policy Division, WTB
Won Kim, Policy Division, WTB
William F. Caton, Secretary

Handset Turnover Data

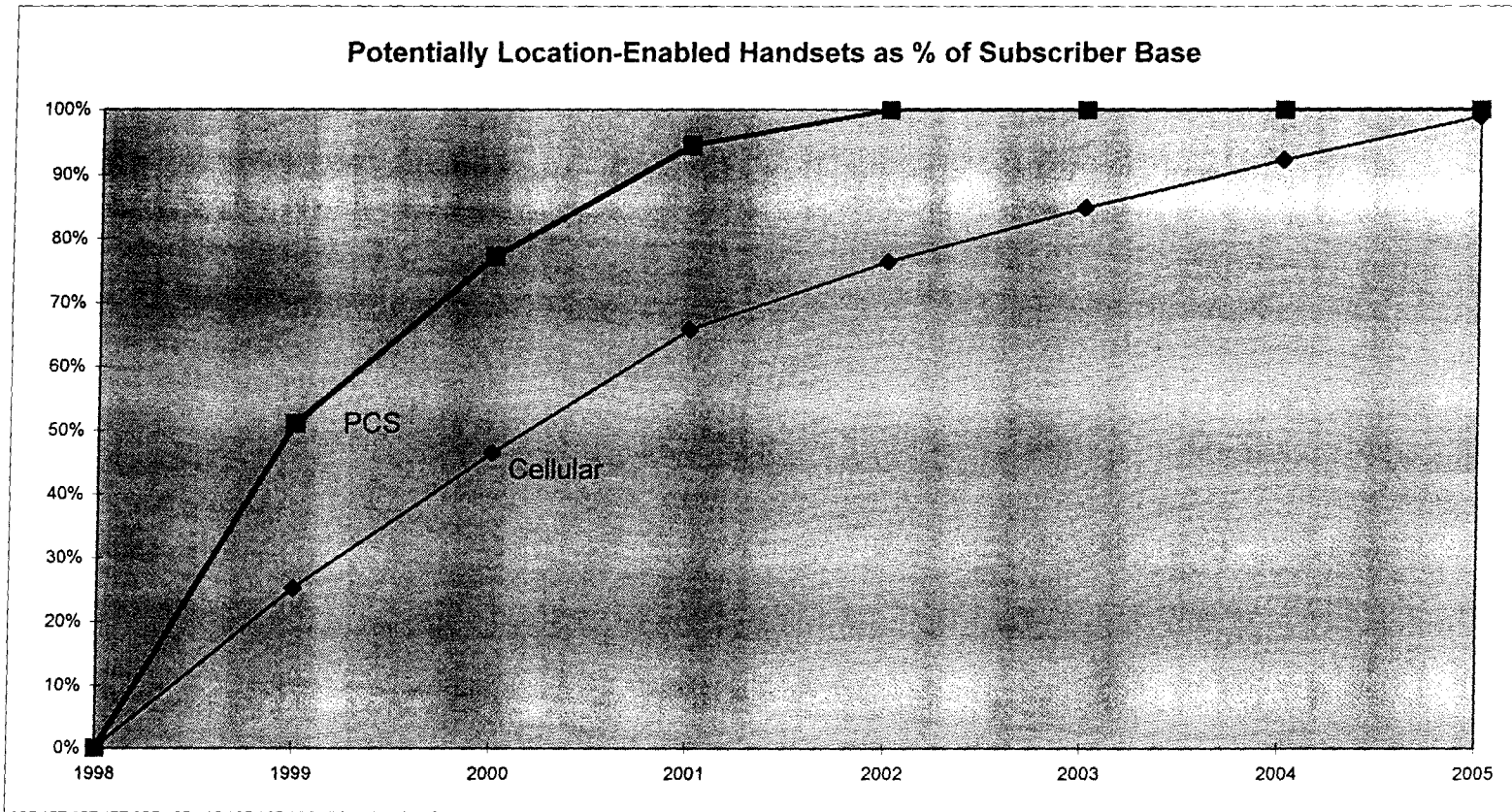
	<u>1995</u>	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>
Cellular subscribers	33,786	43,500	51,151	58,150	64,151	69,150	73,900	78,400	82,400	86,300	90,100
Cellular handsets sold	16,074	17,674	16,572	16,668	16,100	15,953	16,534	11,250	10,000	9,750	9,500
Net cellular adds	9,652	9,714	7,650	7,000	6,000	5,000	4,750	4,500	4,000	3,900	3,800
Cellular handsets sold per net add	1.67	1.82	2.17	2.38	2.68	3.19	3.48	2.5	2.5	2.5	2.5
Cumulative cellular handsets sold beginning in 1999					16,100	32,053	48,587	59,837	69,837	79,587	89,087
Location-enabled handsets could be available commercially by 1999.											
Cellular handsets potentially-location enabled as % of cellular subscribers					25%	46%	66%	76%	85%	92%	98%
<hr/>											
PCS subscribers	30	300	3,000	7,000	11,500	16,250	21,250	26,500	32,000	37,600	43,300
PCS handsets sold	30	306	3,056	4,832	5,866	6,681	7,525	6,563	6,875	7,000	7,125
Net PCS adds	30	270	2,700	4,000	4,500	4,750	5,000	5,250	5,500	5,600	5,700
PCS handsets sold per net add	1.00	1.13	1.13	1.21	1.30	1.41	1.51	1.25	1.25	1.25	1.25
Cumulative PCS handsets sold beginning in 1999					5,866	12,547	20,072	26,635	33,510	40,510	47,635
Location-enabled handsets could be available commercially by 1999.											
PCS handsets potentially-location enabled as % of PCS subscribers					51%	77%	94%	100%	100%	100%	100%

By the end of 2001, handsets purchased by 66% of cellular subscribers and 94% of PCS subscribers could be location-enabled.

The continuing of penetration of potentially location-enabled handsets is shown (shaded area) using extremely conservative projections for handsets per net add. Assumptions (and calculations based on assumptions) are shown in italics.

Data source: Donaldson, Lufkin & Jenrette, "The Wireless Communications Industry", Spring 1997

Handset Turnover Data



Data source: Donaldson, Lufkin & Jenrette, "The Wireless Communications Industry", Spring 1997



The Wireless Infrastructure Market:

No Longer "Probably Coming Soon"

Industry Report
February 24, 1997

Rakesh Sood

LEGAL NOTES AND DISCLOSURES

The notes applicable to the companies mentioned in this report are as follows:

Analog Devices	f
California Microwave	f
Motorola, Inc.	f
QUALCOMM, Inc.	f
Sawtek, Inc.	a & b
Spectrian Corporation	a
Texas Instruments	f


Definitions of Legal Notes

- (a) Hambrecht & Quist LLC maintains a market in these stocks.
- (b) Hambrecht & Quist LLC has been an underwriting manager, or co-manager, or has privately placed securities of these companies within the last three years.
- (f) Options are available on these issues.

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The information contained herein is based on sources believed to be reliable, but is neither all-inclusive nor guaranteed by our firm. Opinions reflect our judgement at this time and are subject to change. In the course of our regular business, we may be long or short in the securities mentioned and may make purchases and/or sales of them from time to time in the open market or otherwise.

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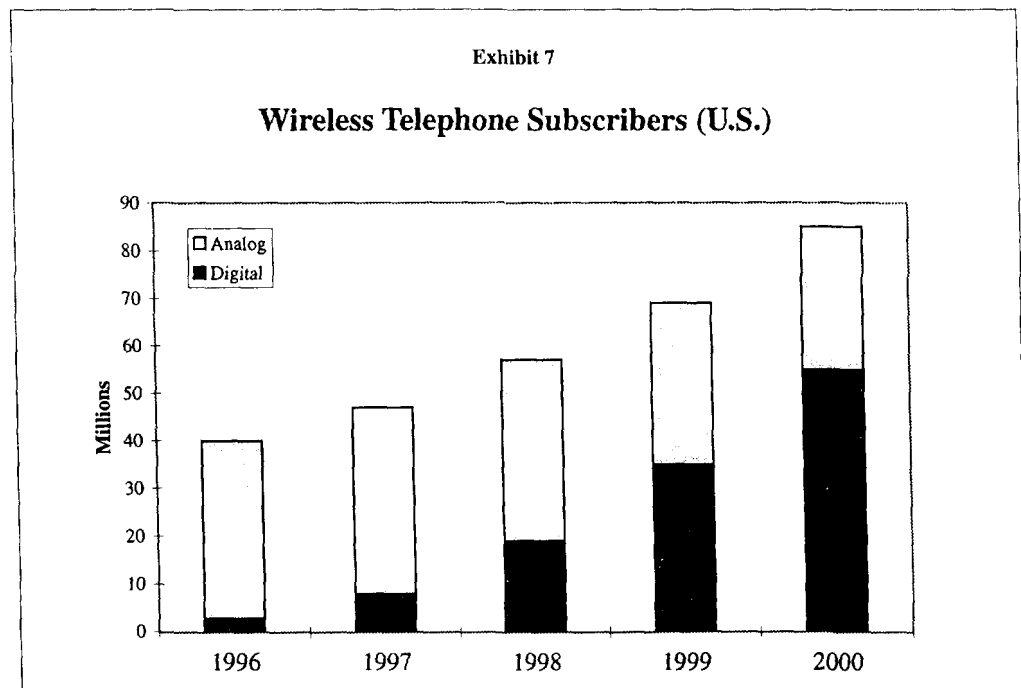
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expect interfaces between the switch and the base station as well as between the switch and the adjunct platform/server for a variety of mobile service applications and functions.

- **Network Management and Mobile Application Platform.** An increasing number of base stations required for PCS, as well as the need to manage large numbers of new subscribers unleashed by multiple service providers increases the challenges of a management platform that must be designed to address multiple applications, including messaging, customized billing, database searches, fraud, and subscriber churn management. We expect providers of billing and customer care solutions (for example, Saville Systems – SAVLY) to benefit from the aforementioned PCS/cellular deployment.

HANDSETS – SUBSCRIBER GAINS ARE LIKELY TO OFFSET MARGIN EROSION

The handset market in the United States has been predominantly analog (AMPS) with a 35% to 40% unit growth rate until the second half of 1995. Intense price competition caused price declines in excess of 25% per annum amidst a plethora of United States, European, and Japanese cellular phone manufacturers, and revenue growth has been anemic at best at approximately 10% per year (see Exhibit 7). In the absence of real service pricing competition in the United States, the growth in subscribers over the last 18 months has been rather sluggish.

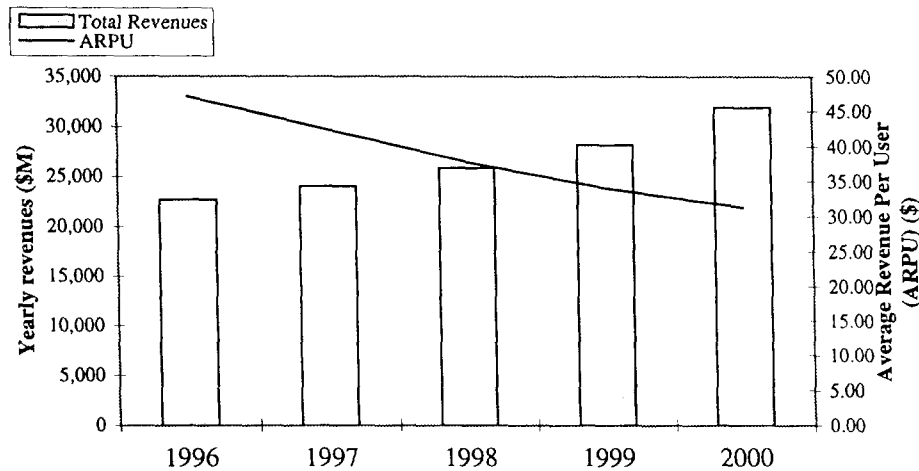


Source: IDC, CTIA, H&Q

This scenario is about to change with the onset of digital cellular and PCS services. As shown in Exhibit 8, we expect digital subscribers to exceed analog-only subscribers in 1998 with the total handset market exceeding \$20 billion over the next five years.

Exhibit 8

Wireless Subscriber Market Opportunity (U.S.)



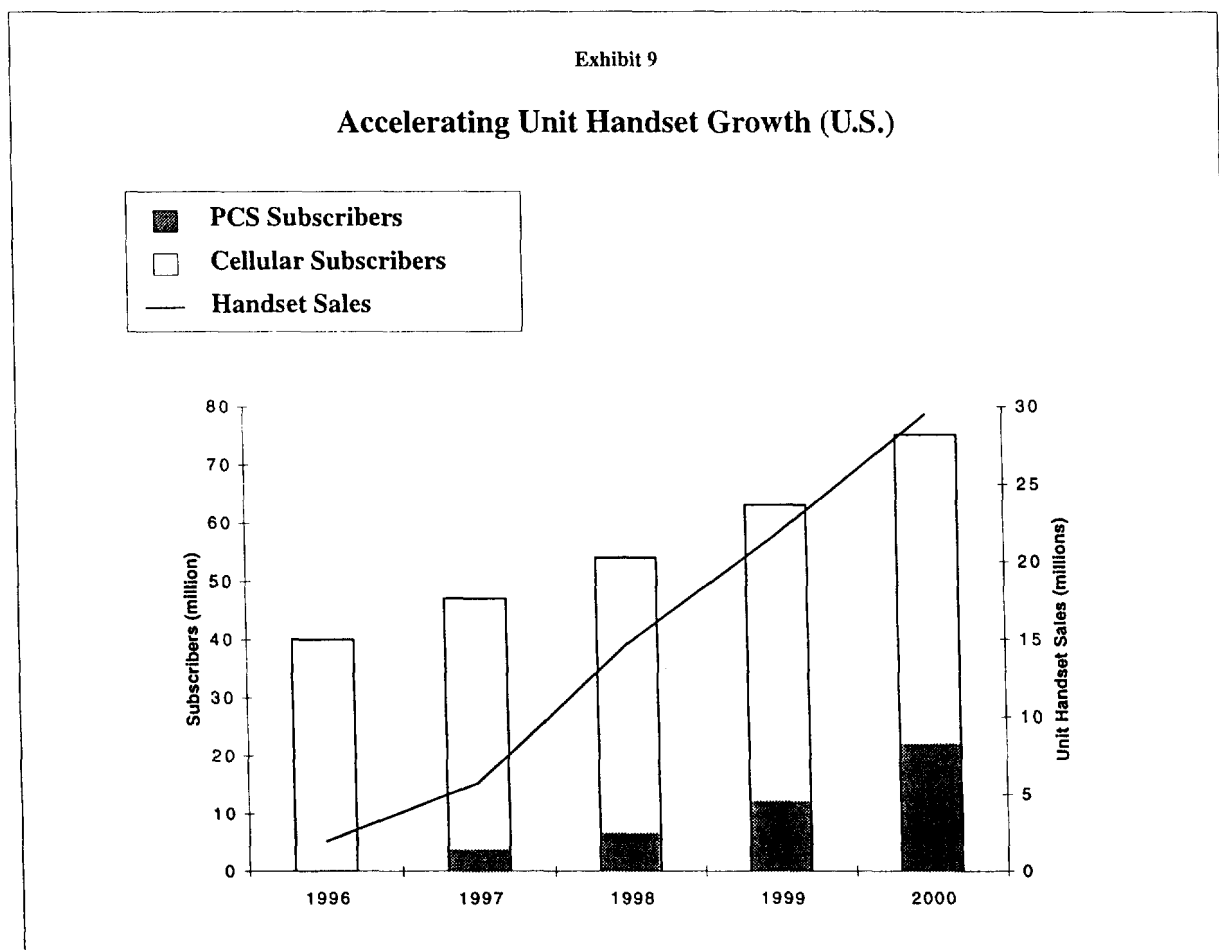
Source: IDC, H&Q

We believe the following drivers will be key to rejuvenating growth in handsets over the next five years:

- Conversion from Analog Service to Digital.** Digital phones have higher ASPs (\$350 to \$450) than analog phones (\$150 to \$200) and the digital market has been less competitive, with Motorola, Nokia, and Ericsson being the significant players. On the other hand, the analog phone market has had almost two dozen competitors. While we believe that digital phones are likely to experience the price erosion of their analog brethren, they are starting at a higher price point and, more significantly, are likely to maintain a perceived premium from a subscriber viewpoint, driven primarily by additional features and improved voice clarity.
- Onset of Service Price Competition.** Service prices have stayed high with the cellular duopoly structure, and the new crop of PCS service providers are about to shake that equilibrium. Furthermore, cellular providers are offering aggressive service plans to preempt the new entrants. The net effect is an expectation of lower service pricing going forward. While we have seen a decline in ARPU over the last several years (from \$81 in 1990 to \$47 in 1996), the decline has been driven almost wholly by low usage net additions to the subscriber base rather than any proactive price cuts offered by the service providers. With multiple PCS providers in many markets and a subsequent real service price decline, we expect to see a stimulative effect of subscriber growth and handset growth as well. Furthermore, as additional services are offered and minutes-of-use driven higher, we expect additional motivations to increase capacity and coverage, increasing the opportunity to more aggressively seek additional subscribers (see Exhibit 7).
- Proliferation of Multiple Handset Types.** With multiple service providers come multiple handset choices, especially because the market in the United States has chosen to embrace several digital standards, not only for PCS but

also for cellular. Consequently, TDMA, GSM, and CDMA versions of phones are available at PCS frequencies, as well as versions of TDMA and CDMA for cellular frequencies. More significantly, dual-mode phones will soon be available for purchase (those that operate at analog cellular (800 Mhz) frequencies as well as at PCS frequencies) using one of the above-mentioned technology options. The combination of digital technology and analog cellular service allows customers to take advantage of features unique to digital as well as enabling roaming use in analog-only service areas. In addition, we are likely to see tri-mode, dual band phones, such as the ones for CDMA announced by Oki Telecom at PCS 1996, with digital operation at PCS and cellular frequencies, as well as for analog cellular.

- Overall, the multiplicity of service offerings and phone choices implies that *we are entering an era where an increasingly higher number of phones are likely to be sold per net added subscribers than ever before.* In addition to a shorter upgrade cycle as well as multiple phones per subscriber in several instances, we expect normal churn, as well as loss/theft, etc., to fuel the growth in the handset replacement market. Consequently, we believe that the handset to subscriber ratio, which we estimate currently at 1.3, is likely to climb to 1.8 by 2000, thereby considerably amplifying the handset growth stimulated by expected net subscriber additions of 45 million in the United States and over 220 million worldwide by 2000 (see Exhibit 9).



Source: Dataquest, IDC, H&Q

Table 13A
US Cellular Phone Market

		1995	1996	1997	1998	1999	2000	2001
US-Cellular Subscribers (000)		33,786	43,500	51,150	58,150	64,150	69,150	73,900
Subscribers mix	Analog	99%	95%	85%	70%	60%	50%	39%
	TDMA	1%	5%	10%	20%	25%	30%	32%
	CDMA	0%	0%	5%	10%	15%	20%	29%
End of year subscribers (000)								
	Analog	33,448	41,238	43,478	40,705	38,490	34,575	28,821
	TDMA	338	2,175	5,115	11,630	16,038	20,745	23,648
	CDMA	0	87	2,558	5,815	9,623	13,830	21,431
Net New Adds (000)								
	Analog	9,314	7,790	2,240	-2,772	-2,215	-3,915	-5,754
	TDMA	338	1,837	2,940	6,515	4,408	4,708	2,903
	CDMA	0	87	2,471	3,258	3,808	4,208	7,601
	Total	9,652	9,714	7,650	7,000	6,000	5,000	4,750
Churn Assumptions								
Assumed Monthly %								
	Analog	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%
	TDMA	0.0%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%
	CDMA	0.0%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%
Customers churn (000)								
	Analog	6,422	7,918	8,348	7,815	7,390	6,638	5,534
	TDMA	0	444	1,043	2,373	3,272	4,232	4,824
	CDMA	0	18	522	1,186	1,963	2,821	4,372
	Total	6,422	8,379	9,913	11,374	12,625	13,692	14,730
% lost to PCS		0.0%	5.0%	10.0%	15.0%	20.0%	20.0%	20.0%
New phones from churn (000)								
	Analog	6,358	7,546	7,583	6,768	6,060	5,477	4,596
	TDMA	64	398	892	1,934	2,525	3,286	3,771
	CDMA	0	16	446	967	1,515	2,191	3,417
	Total	6,422	7,960	8,922	9,668	10,100	10,953	11,784
Total new phone sales (000)								
	Analog	15,672	15,336	9,823	3,995	3,845	1,562	-1,158
	TDMA	402	2,235	3,832	8,449	6,932	7,994	6,674
	CDMA	0	103	2,917	4,224	5,322	6,398	11,018
	Total	16,074	17,674	16,572	16,668	16,100	15,953	16,534
\$ per phone								
	Analog	\$220	\$198	\$178	\$160	\$144	\$130	\$117
	TDMA	420	294	\$265	\$238	\$214	\$193	\$174
	CDMA		400	300	255	217	\$195	\$176
Phone market (\$000)								
	Analog	\$3,447,832	\$3,036,551	\$1,750,431	\$640,736	\$554,976	\$202,874	\$0
	TDMA	168,874	540,119	777,924	1,551,482	944,642	908,046	503,973
	CDMA	0	34,800	741,150	830,663	825,276	820,778	1,334,489
	Total	\$3,616,706	\$3,611,470	\$3,269,505	\$3,022,881	\$2,324,893	\$1,931,698	\$1,838,461

Table 13B
US PCS 1900 Phone Market

		1995	1996	1997	1998	1999	2000	2001
PCS Subscribers (000)		30	300	3,000	7,000	11,500	16250	21250
Technology Mix	TDMA	0%	25%	40%	30%	25%	18%	14%
	GSM	100%	70%	50%	50%	50%	44%	45%
	CDMA	0%	5%	10%	20%	25%	39%	41%
Subscriber mix (000)	TDMA	0	75	1,200	2,100	2,875	2,925	2,975
	GSM	30	210	1,500	3,500	5,750	7,069	9,563
	CDMA	0	15	300	1,400	2,875	6,256	8,713
Net New Adds (000)	TDMA	0	75	1,125	900	775	50	50
	GSM	30	180	1,290	2,000	2,250	1,319	2,494
	CDMA	0	15	285	1,100	1,475	3,381	2,456
	Total	30	270	2,700	4,000	4,500	4,750	5,000
Churn Assumptions Assumed Monthly %	TDMA		1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
	GSM		1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
	CDMA		1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Customers churn	TDMA	0	9	144	252	345	351	357
	GSM	0	25	180	420	690	848	1,148
	CDMA	0	2	36	168	345	751	1,046
	Total	0	36	360	840	1,380	1,950	2,550
% lost to cellular		1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
# new of phones from churn	TDMA	0	9	143	249	342	347	353
	GSM	0	25	178	416	683	840	1,136
	CDMA	0	2	36	166	342	743	1,035
	Total	0	36	356	832	1,366	1,931	2,525
Total New Phone Sales	TDMA	0	84	1,268	1,149	1,117	397	403
	GSM	30	205	1,468	2,416	2,933	2,159	3,630
	CDMA	0	17	321	1,266	1,817	4,124	3,491
	Total	30	306	3,056	4,832	5,866	6,681	7,525
\$ Per PCS Phone	TDMA		\$294	\$265	\$238	\$214	\$193	\$174
	GSM		\$294	\$265	\$238	\$214	\$193	\$174
	CDMA		\$400	\$300	\$255	\$217	\$195	\$176
Phones Market	TDMA		\$24,670	\$335,396	\$273,737	\$239,306	\$76,673	\$70,037
	GSM		60,255	388,486	575,299	628,640	416,364	630,144
	CDMA		6,713	96,192	322,912	393,737	804,585	612,958
Total PCS Phones \$			\$91,637	\$820,074	\$1,171,947	\$1,261,682	\$1,297,622	\$1,313,139

Table 13C
Rest of World Mobile Phone Market

		1995	1996	1997	1998	1999	2000	2001
ROW Wireless Subscribers (000)		53,000	93,016	150,666	219,666	304,166	394,416	494,666
Subscriber mix	Analog	65%	55%	47%	38%	30%	22%	16%
	GSM/TDMA	35%	45%	50%	55%	60%	65%	68%
	CDMA	0%	0%	3%	7%	10%	13%	16%
End of year subscribers (000)	Analog	34,450	50,787	70,813	83,473	91,250	86,772	79,147
	GSM/TDMA	18,550	41,857	75,333	120,816	182,500	256,370	336,373
	CDMA	0	372	4,520	15,377	30,417	51,274	79,147
Net New Adds (000)	Analog	20,050	16,337	20,026	12,660	7,777	-4,478	-7,625
	GSM/TDMA	4,150	23,307	33,476	45,483	61,683	73,871	80,002
	CDMA	0	372	4,148	10,857	15,040	20,857	27,872
	Total	24,200	40,016	57,650	69,000	84,500	90,250	100,250
Churn Assumptions Assumed Monthly %	Analog	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
	GSM/TDMA	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
	CDMA	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Customer churn (000)	Analog	4,134	6,094	8,498	10,017	10,950	10,413	9,498
	GSM/TDMA	2,226	5,023	9,040	14,498	21,900	30,764	40,365
	CDMA	0	45	542	1,845	3,650	6,153	9,498
	Total	6,360	11,162	18,080	26,360	36,500	47,330	59,360
New phones from churn (000)	Analog	4,134	6,094	8,498	10,017	10,950	10,413	9,498
	GSM/TDMA	2,226	5,023	9,040	14,498	21,900	30,764	40,365
	CDMA	0	45	542	1,845	3,650	6,153	9,498
	Total	6,360	11,162	18,080	26,360	36,500	47,330	59,360
Total phone sales (000)	Analog	24,184	22,431	28,524	22,677	18,727	5,934	1,873
	GSM/TDMA	6,376	28,330	42,516	59,981	83,583	104,635	120,367
	CDMA	0	417	4,690	12,702	18,690	27,010	37,370
	Total	30,560	51,178	75,730	95,360	121,000	137,580	159,610
\$ per phone	Analog	\$319	\$277	\$241	\$208	\$180	\$143	\$129
	GSM/TDMA	\$609	\$412	\$357	\$310	\$268	\$212	\$191
	CDMA	\$0	\$560	\$405	\$332	\$271	\$215	\$193
Phones Market (\$000)	Analog	\$7,714,696	\$6,217,913	\$6,861,982	\$4,727,983	\$3,378,811	\$848,003	\$240,836
	GSM/TDMA	3,882,984	9,593,244	11,957,891	14,080,811	16,525,419	15,674,109	15,277,631
	CDMA	0	208,356	1,679,906	3,598,976	4,074,895	4,475,650	5,382,852
	Total	\$11,597,680	\$16,019,513	\$20,499,778	\$22,407,770	\$23,979,124	\$20,997,762	\$20,901,319